

## METHOD FOR DETERMINING THE LIMITING REACTANT

- When working out limiting reactant problems, the most straightforward case is when the mole ratio of the reactants is 1:1. In such cases, the reactant present in the smaller molar amount will be the limiting reagent. When the ratio is different from 1 : 1 (i.e., 2 : 3 or 3 : 5), then more work is required in determining the limiting reactant.
- The general method for determining the limiting reactant is as follows:
  - write down and examine the balanced chemical equation
  - identify the quantities of reactants present and convert them into molar quantities
  - calculate the amount of product produced for each of the reactants (in general, when two or more products are listed, choose the product for which you want to obtain quantitative information)
  - the reactant that produces the least amount of desired product is called the limiting reactant
  - identify the amount of product produced based on the limiting reactant and convert it to mass or number of particles as directed by the question
- Here is a quick method for determining the limiting reactant. Consider the reaction:  $x\text{A} + y\text{B} \rightarrow z\text{C}$  (where  $x$ ,  $y$ , and  $z$  are all coefficients from the balanced chemical equation). This method can be introduced to students after they have a firm grasp of the more ponderous method and understand the reasoning behind it.
  1. Calculate the number of moles of A and B.  
$$\frac{m(\text{A})}{M_{\text{A}}} \text{ and } \frac{m(\text{B})}{M_{\text{B}}}$$
  2. Divide the molar quantities of each reactant by their coefficients listed in the balanced chemical equation.  
$$\frac{\text{mol A}}{x} \text{ and } \frac{\text{mol B}}{y}$$
  3. The reactant with the smallest value obtained from these two calculations is the limiting reactant. One caveat is that the value obtained by using this quick method should not be used any further in the stoichiometric problem. It should only be used to find the limiting reactant.
- Provide students with clues on how to recognize a limiting reactant problem. Questions in chemistry that ask “how much” are usually stoichiometric problems. When the question involves a question similar to “How much product will form from  $x$  grams of reactant?”, the problem is a simple stoichiometric problem that can be solved using conventional methods. When the problem states fixed amounts of two or more reactants, the problem should be treated as a limiting reactant problem as it is likely that one reactant will run out first.